TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 USC 371

International Application No.:	PCT/FR97/01835
International Filing Date:	10/15/97
Priority Date Claimed:	10/16/96
Title of Invention:	PROCESS AND PLANT FOR THE HEAT TREATMENT OF WASTE PRODUCTS
Applicant(s) for DO/EO/US:	Louis Rousseau

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. (X) This is a **FIRST** submission of items concerning a filing under 35 USC 371.

2. () This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 USC 371.

3. () This express request to begin national examination procedures (35 USC 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 USC 371(b) and PCT Articles 22 and 39(1).

4. (X) A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.

5. (X) A copy of the International Application as filed (35 USC 371(c)(2))

   a) () is transmitted herewith (required only if not transmitted by the International Bureau).
   b) (X) has been transmitted by the International Bureau.
   c) () is not required, as the application was filed in the United States Receiving Office (RO/US).

6. (X) A translation of the International Application into English (35 USC 371(c)(2)).

7. (X) Amendments to the claims of the International Application under PCT Article 19 (35 USC 371(c)(3))

   a) () are transmitted herewith (required only if not transmitted by the International Bureau).
   b) () have been transmitted by the International Bureau.
   c) () have not been made; however, the time limit for making such amendments has NOT expired.
   d) (X) have not been made and will not be made.

Items 11. to 16. below concern other document(s) or information included:

8. (X) A FIRST preliminary amendment.
   () A SECOND or SUBSEQUENT preliminary amendment.

9. (X) International Application as published.

10. (X) International Search Report.

11. (X) A return prepaid postcard.

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				FEES
	BASIC FEE			$840
CLAIMS	**NUMBER FILED**	**NUMBER EXTRA**	**RATE**	
Total Claims	15 - 20 =	0 ×	$18	$0
Independent Claims	2 - 3 =	0 ×	$78	$0
Multiple dependent claims(s) (if applicable)			$260	$0
	TOTAL OF ABOVE CALCULATIONS		$840	
	TOTAL NATIONAL FEE			$840

12. (X) The fee for later submission of the signed oath or declaration set forth in 37 CFR 1.492(e) will be paid upon submission of the declaration.

13. (X) The Commissioner is hereby authorized to charge only those additional fees which may be required to avoid abandonment of the application, or credit any overpayment to Deposit Account No. 11-1410. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

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JWK-1136.DOC
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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	:	Louis Rousseau
Int'l Appl. No.	:	PCT/FR97/01835
Int'l Filing Date	:	October 15, 1997
For	:	METHOD AND DEVICE FOR HEAT TREATMENT OF WASTE PRODUCTS
Examiner	:	Unknown

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Washington, D.C. 20231

Dear Sir:

Prior to examination on the merits, please amend the above-captioned U.S. national phase application as follows:

IN THE SPECIFICATION:

On page 1 of the Specification, after the Title of the Invention ending on line 1 and before the sentence on line 3 which begins, "The subject-matter...", please insert --This is the U.S. national phase under 35 U.S.C. § 371 of International Application PCT/FR97/01835, filed October 15, 1997.--.

On page 5, line 5, please delete "kcal/Sm^3" and substitute --kcal/Nm^3-- in its place.

IN THE CLAIMS:

Please amend the claims as follows:

1. (Amended) A [**P**]process for the heat treatment of waste, comprising:

pyrolyzing said waste, [**in which pyrolysis is carried out in order to distill, at low temperature (600 to 700°C) and in the absence of oxygen, all the combustible waste, whatever its**] said waste having a net calorific value (NCV), [**and in order to**]

thereby produc[e]ing coke and fuel gases; [**, rich in CO, CH_4 and various tars, which can subsequently be incinerated at 1200°C under spontaneous combustion in a specific chamber, characterized in that the hot gas flow necessary for the pyrolysis of the waste in the course of distillation is provided by the**]

combusting[**on of**] the coke with a deficiency of air, [**the gases produced moving countercurrentwise to the solids**] thereby producing hot gases for the pyrolysis of the waste.

2. (Amended) [**Plant**] An apparatus for the [**heat treatment**] pyrolysis of waste [**for the implementation of the process according to Claim 1**], comprising a rotating cell [**(1)**] formed of a cylinder [**(9)**], said cylinder having a diameter and two ends, in combination with a truncated cone [**(10)**] rotating on the same axis, said truncated cone having a large base and a small base, said large base and said small base each having a diameter, [**and comprising**] a hopper for charging the waste [**(3)**] at one end of said cylinder , an ash box [**(7)**] at the other end of said cylinder, [**and**] a gas recuperator [**(6), characterized in that**], and a retaining threshold [**(11) lies**] between the cylinder [**cylindrical chamber (9)**] and the [**frustoconical chamber (10)**] truncated cone, creating a region of intimate contact of the waste with itself [**during coking, where it receives a small amount of oxygen in a substoichiometric amount, in order to**], whereby the waste is converted [**it**] into coke which is used as fuel in the pyrolysis of the waste.

3. (Amended) [**Plant**] The apparatus according to Claim 2, [**characterized in that**] wherein the retaining threshold [**(11) for the waste connecting the cylinder (9) and the truncated cone (10)**] is formed by [**the**] a difference between the diameter [**(12)**] of the cylinder [**(9)**] and the diameter [**(13)**] of the large base of the truncated cone [**(10)**].

4. (Amended) [**Plant**] The apparatus according to Claim 2, [**characterized in that**] wherein the truncated cone [**(10) of the cell (1)**] further comprises a network of nozzles fed via channels distributing [**the**] combustion air [**(14)**] in a substoichiometric amount [**under the ignited coke in order to provide the heat flow necessary for the pyrolysis**], thereby combusting the coke which is used as fuel in the pyrolysis of the waste.

Please add the following new claims:

5. The method of Claim 1, wherein the waste is pyrolyzed at a temperature of 600 to 700° C.

6. The method of Claim 1, wherein the waste is pyrolyzed in the absence of oxygen.

7. The method of Claim 1, wherein said fuel gases are rich in CO, CH_4, and various tars.

8. The method of Claim 1, further comprising incinerating said fuel gases.

9. The method of Claim 8, wherein said fuel gases are incinerated at 1200° C under spontaneous combustion.

10. The method of Claim 1, wherein said waste has a net calorific value (NCV) of 1500 to 10,000 kcal/kg.

11. The method of Claim 1, wherein said hot gases for the pyrolysis of the waste move countercurrent to the waste.

12. The method of Claim 1, wherein said coke is produced by contacting the waste with itself by retaining the waste on a retaining threshold.

13. The method of Claim 12, further comprising feeding combustion air in a substoichiometic amount through nozzles, thereby combusting said coke.

14. The method of Claim 13, wherein combusting said coke provides heat for the pyrolysis of said waste.

15. The method of Claim 1, wherein said fuel gases have a net calorific value (NCV) of 900 to 1100 kcal/Nm^3.

IN THE ABSTRACT:

Please include the attached abstract as page 8 of the specification.

Remarks

Claims 1-4 have been amended to more precisely claim the invention according to conventional practice before the United States Patent and Trademark Office. New Claims 5-15 have been added. As a result, Claims 1-15 are presented for examination. Support of new Claim 10 can be found on page 5, lines 1-3. Support for new Claims 12 and 13 can be found, for example, in original Claims 2 and 4. Support for new Claim 15 can be found on page 5, lines 4

to 5. In addition, an Abstract of the Invention has been added. No new matter is being added herewith.

Should there be any questions concerning is application, the Examiner is respectfully invited to contact the undersigned attorney at the telephone number appearing below.

Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

DEA 4/16/99

Dated: 16 ~~Jan.~~ Apr. 1999

By: Daniel Altman

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Process and plant for the heat treatment of waste

The subject-matter of the present invention is a process for the heat treatment of waste, in particular, but not exclusively, domestic and industrial waste, and the plant for its implementation, of the type comprising a rotating combustion cell into which the waste is introduced via a charging end, whereas the slag is collected at the other end, while the gases are recovered upstream or downstream of the cell.

Currently, in this type of rotary kiln, the waste is combusted exothermally by introducing oxidizing air, the effect of which is to bring combustion of all the hydrocarbonaceous materials present in the waste to completion, the stirring of which, during its displacement towards the ash box, is provided by the rotation of the cylindrical and/or conical combustion chamber.

At this stage in the combustion, the gases are 99% incinerated and the clinker has a content of uncombusted material of 2 to 10% in the form of carbon.

The reduction by oxidation of virtually all the hydrocarbonaceous material is reflected by high temperatures of more than 1200°C for waste with a mean net calorific value (NCV) of 2000 kcal/kg, which temperatures can reach more than 1400°C with waste with an NCV of 3500 kcal/kg and more.

These high temperatures result in the following phenomena:

1 - The dust, suspended by the forced aeration of the waste which is found in the fumes, melts and is deposited on the walls of the kiln and of the boiler.

2 - The clinker is also molten and agglomerates on the walls.

To avoid these phenomena, there exists only one solution, to introduce excess air, which air does not participate in the combustion but has the role of

moderating the combustion temperatures to approximately 850-900°C.

However, this excess air exhibits the following disadvantages:

1 - It requires energy in order to be produced and extracted.

2 - The volume of fumes generated is greater and requires gas lines with greater cross sections and volumes.

3 - The toxic and polluting components which are found in the waste are virtually completely entrained in the fumes and require a larger-volume and more complex device in order to scavenge them.

4 - International regulations, which are increasingly restrictive, lay down temperatures for the combustion of fumes which are greater than 1150°C and very low contents of pollutants and dust, which are more particularly generated by combustion with excess air.

5 - The fumes produced at 900°C only make possible an efficiency of 60 to 65% for heat recovery, whereas it is desirable to achieve 80 to 85%.

6 - In a combustion chamber operating with excess air, it is very difficult, if not impossible, to bring under control the energy contribution supplied by waste with an NCV of greater than 3500 kcal/kg.

To overcome these disadvantages, a novel heat treatment process has been devised, using pyrolysis, which makes it possible, in the absence of oxygen, to distil all the waste at a low temperature of the order of 600 to 700°C, whatever its NCV.

This novel process is also targeted at producing fuel gases, rich in CO, CH_4 or various tars, which are incinerated at 1200°C under spontaneous combustion in a specific chamber. These gases, which

only have a slight load of pollutants because of the low temperatures, require a treatment which is markedly less complex and which is markedly smaller in scale than the incineration.

To implement this process, the plant comprises a rotating cell composed of a cylinder and of a truncated cone rotating on the same axis.

Pyrolysis is carried out in the cylindrical part of the cell and, as it is energy-intensive, energy is supplied by the coke produced by itself, the combustion of which takes place in the truncated cone, defined as being the generator of heat for the pyrolysis. The thermal reduction, pyrolysis/combustion of the coke, takes place countercurrentwise, the gases produced moving countercurrentwise to the solids.

To allow pyrolysis, it is necessary to have available in the cell a region in which the waste in the course of distillation is heated by the thermal energy originating from the abovementioned generator. At a certain stage in its heating, the waste needs to be brought into prolonged intimate contact with itself in order to be converted into coke.

The fundamental characteristic of the plant for the heat treatment of waste in question lies essentially in the fact that it comprises this region of intimate contact of the waste with itself determined by a retaining threshold lying between the cylindrical part and the frustoconical part of the rotating cell.

This is because the waste in the course of coking is forced, in crossing this threshold, to form a volume in which the constituents are brought mutually into close contact while receiving a small amount of oxygen. At this instant, the reaction temperature of the waste rises to approximately 700°C. This retaining of the waste, artificially created by the threshold, makes it possible to obtain a coke which is used in the generator cone as fuel to provide the hot gas flow necessary for the pyrolysis.

In this cone, in a known way, the combustion air is distributed under the ignited coke by a network of nozzles fed via channels.

The invention is described below with the help of an example and of references to the appended drawing, in which:

The single figure is a diagrammatic view of the plant for the heat treatment of waste according to the invention.

In the drawing, the indicator 1 denotes the rotating cell driven in rotation by mechanical means represented diagrammatically by the references 2.

Upstream of the cell 1, the arrow 3 denotes the hopper for charging waste, equipped with a flap 4 and a pushing device 5.

The chimney for recovering the pyrolysis gases is denoted by the indicator 6.

An ash box 7 for discharge of the slag or of the coke, symbolized by the arrow 8, is positioned downstream of the cell 1.

It is obvious that the fittings and other devices, such as the charging hopper, the recovery chimney, indeed even the ash box, are known components which are chosen according to the results to be obtained.

The rotating cell 1 is composed, according to the invention, of a cylindrical part 9, constituting the pyrolyser, in combination with a frustoconical part 10, forming the generator. Between the cylinder 9 and the truncated cone 10 lies a region 11 connecting the end 12 of the cylinder 9 and the large base 13 of the truncated cone 10. This region 11 constitutes a retaining threshold for the waste assuming a high conicity resulting from the difference in diameter between the cylinder 9 and the truncated cone 10.

A network of nozzles fed via distribution channels with combustion air is provided in the frustoconical part 10. Arrows 14 symbolize this air supply.

It is found that, by virtue of this plant for the treatment of solid waste with an NCV ranging from 1500 to 10,000 kcal/kg, the following are obtained:

- the production of a pyrolysis gas with an NCV of 900 to 1100 kcal/Sm^3, which gas is only slightly polluted and has a high degree of enhanced value, which is carried out under the best conditions.

- compliance with the strictest antipollution standards with reduced means.

- a substantial reduction in the size and the cost of the installations.

Claims

1. Process for the heat treatment of waste, in which pyrolysis is carried out in order to distil, at low temperature (600 to 700°C) and in the absence of oxygen, all the combustible waste, whatever its net calorific value (NCV), and in order to produce coke and fuel gases, rich in CO, CH_4 and various tars, which can subsequently be incinerated at 1200°C under spontaneous combustion in a specific chamber, characterized in that the hot gas flow necessary for the pyrolysis of the waste in the course of distillation is provided by the combustion of the coke with a deficiency of air, the gases produced moving countercurrentwise to the solids.

2. Plant for the heat treatment of waste for the implementation of the process according to Claim 1, comprising a rotating cell (1) formed of a cylinder (9) in combination with a truncated cone (10) rotating on the same axis and comprising a hopper for charging the waste (3) at one end, an ash box (7) at the other end and a gas recuperator (6), characterized in that a retaining threshold (11) lies between the cylindrical chamber (9) and the frustoconical chamber (10), creating a region of intimate contact of the waste with itself during coking, where it receives a small amount of oxygen in a substoichiometric amount, in order to convert it into coke which is used as fuel in the pyrolysis of the waste.

3. Plant according to Claim 2, characterized in that the retaining threshold (11) for the waste connecting the cylinder (9) and the truncated cone (10) is formed by the difference between the diameter (12) of the cylinder (9) and the diameter (13) of the large base of the truncated cone (10).

4. Plant according to Claim 2, characterized in that the truncated cone (10) of the cell (1) comprises a network of nozzles fed via channels distributing the combustion air (14) in a substoichiometric amount under

the ignited coke in order to provide the heat flow necessary for the pyrolysis.

Abstract of the Invention

An apparatus and method are for the pyrolysis of waste. The aparatus has a rotating cell formed of a cylinder in combination with a truncated cone rotating on the same axis. The apparatus also has a hopper for charging the waste at one end of the cylinder, an ash box at the other end of the cylinder, a gas recuperator, and a retaining threshold between the cylinder and the truncated cone. A region of intimate contact of the waste with itself is created, whereby the waste is converted into coke which is used as fuel in the pyrolysis of the waste.

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Attorney's Docket No.: VANMA107.001APC

DECLARATION USA PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name;

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled: METHOD AND DEVICE FOR HEAT TREATMENT OF WASTE PRODUCTS the specification of which:

(a) ☐ is attached hereto; or

(b) ☐ was filed on April 16, 1999 as Application No. 09/284,690 or Express Mail No., as Application No. not yet known _____ and was amended on April 16, 1999; or

(c) ☐ was described and claimed in PCT International Application No. _____ filed on _____ and as amended under PCT Articles 19 on _____ (if any) and/or under PCT Articles 34 on _____ (if any).

I hereby state that I have reviewed and understand the contents of the above identified specification including the claims, as amended by any amendment referred to above;

I acknowledge the duty to disclose information which is material to the patentability of this application in accordance with Title 37, Code of Federal Regulations, § 1.56;

I hereby claim foreign priority benefits under Title 35, United States Code, § 119 of any foreign application(s) for patent, design or inventor's certificate or any PCT international application(s) listed below and have also identified below any foreign application(s) for patent, design or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed for the same subject matter having a filing date before that of the application(s) of which priority is claimed:

PRIOR FOREIGN APPLICATION(S)

COUNTRY (OR INDICATE IF PCT)	APPLICATION NUMBER	DATE OF FILING (day, month, year)	PRIORITY CLAIMED UNDER 37 U.S.C. § 119
PCT	PCT/FR97/01835	10-15-97	☒ YES NO ☐
			☐ YES NO ☐

I hereby claim the benefit under Title 35, United States Code, § 120 of any United States application(s) listed below, and insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code § 112, I acknowledge the duty to disclose to the U.S. Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56, which became available between the filing date of the prior application and the national or PCT international filing date of this application:

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful, false statements may jeopardize the validity of the application or any patent issued thereon.

1-00

Full name of sole inventor: Louis Rousseau

Inventor's signature _____ Day 02 Month July Year 1999

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